

If more molecules are formed than can escape from the film, they will be back-reflected to the filament. The partial pressure of PtO_2 in the oxygen-rich atmosphere at the filament surface will then exceed the equilibrium value and platinum must be re-deposited.

Dr Fryburg suggests in his paper that any back-reflected molecule of PtO_2 on striking the hot filament from which it was earlier formed will automatically be decomposed by reason of its instability at the high temperature. It seems important to appreciate that PtO_2 will only be unstable if the partial vapour pressure of PtO_2 in the surrounding gas is equal to or exceeds the equilibrium value.

Many matters for speculation admittedly still remain. Does the viscous gas film hinder the access of oxygen molecules to the filament, as well as trapping PtO_2 molecules already

formed? If so, is such shielding or is back-reflection the more important factor in reducing evaporation? It is interesting that there seems little visible evidence of re-deposition of platinum in photographs of the surfaces of heated specimens (3).

But it would seem that an excellent case has been made out for the existence on a platinum filament heated in air of a viscous tightly-bound layer of gas which, at atmospheric pressures, prevents 99.85 per cent of the molecules of PtO_2 that should be formed from ever escaping into the surrounding atmosphere.

References

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Platinum as a Propane Fuel Cell Electrocatalyst

COMPARISON WITH OTHER PLATINUM GROUP METALS

The exceptional activity of the platinum metals as electrocatalysts in low-temperature fuel cells has been noted for some years. Numerous studies have been carried out to examine their behaviour in a variety of systems, and among recent published work in this field have been papers describing platinum black anodes operating in phosphoric acid at 110 to 200°C with hydrocarbon fuels (1, 2).

A more recent comparison of four platinum metals under similar conditions was carried out by W. T. Grubb of the General Electric Company, Schenectady, and confirmed the marked superiority of platinum over palladium, rhodium and iridium (3). The metals were Teflon-bonded to the anode structures in the form of their blacks, and their electrocatalytic performances compared at 150°C in an 85 per cent phosphoric acid electrolyte using propane as fuel. During test runs when hydrogen was employed as the fuel, both platinum and iridium gave very high current densities, exceeding 800 mA/cm². Using propane, however, platinum proved very much more active than iridium, sup-

porting more than 1000 times the current density although its surface area was substantially lower than that of iridium. Palladium and rhodium gave only marginally better results with propane than iridium.

The fact that the difference in catalytic activities between platinum and iridium is so large in hydrocarbon oxidation, whereas it is much less in the oxidation of hydrogen and other catalytic reactions, is remarkable, particularly in view of the close similarities in electronic and crystal structures of the two metals.

It is assumed that very specific catalytic properties are required for hydrocarbon electro-oxidation in the moderate temperature region.

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References

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